BINOD BIHARI MAHTO KOYALANCHAL

UNIVERSITY

SYNOPSIS ON

STUDIES ON COMPARATIVE ACCOUNT OF SOIL QUALITY OF COAL MINING AREAS AND AGRICULTURAL LAND OF DHANBAD DISTRICT, JHARKHAND AND ITS REMEDIAL MEASURES FOR ECO-RESTORATION.

For

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Introduction:

Coal mining is the backbone for all industrial sectors as well as important for all daily needs of human life directly or indirectly. It helps to increase our economy but on the other side it degrades the quality of soil, air and water due to improper coal extraction practices. It degrades the quality of the environment [1]. These practices led to global warming, climate change and increase in concentration of carbon dioxide, forest fire, etc. As a result such consequences threat to our flora and fauna, decrease in the percentage of forest and fertility of land and alter the bare land also called as desertification. [Odum]

Impact of open cast mining project leads to:

1. Alteration in the Physico- Chemical characteristics of soil quality.
2. Adverse rehabilitation.
3. Resettlement.
4. Change in socio-economic culture heritage.

Origin of soil completely comes from pedogenesis from rock by physical, chemical and biological weathering process which occurs on rock; rocks are of three types:

a) Igneous rock or parent rock.

b) Sedimentary rock.

c) Metamorphic rock.

Due to such variation in rocks its shows different quality of soil and in their types. Soil is one of the most valuable non- renewable natural resources. The word soil derived from Latin word solum which means earthy material on the other word we can say that soil is skin of earth crust which is important abiotic component of the environment. Its supply nutrient to producers and indirectly provide food to different trophic level of the food chains for instant;

Soil nurtient→ Producer→Herbivores→carnivorus→omnivorous.

Soil composition includes of mineral matter, organic matter, air, and water which help plants to grow on it and soil texture helps to determine physical properties and in infiltration of groundwater recharge, permeability, water holding capacity, moisture content, bulk density and Electrical conductivity [2, 3 ,4,5& 6]. Whereas soil profile is important tool for nutrient management and help in to know fertility of the terrestrial ecosystem.

On the basic of the fertility of soil nutrients is divided into two categories:

(a) Macro nutrient and [12]

(b) Micro nutrient. [12]

These above types of nutrients help in the fertility and complex quality of soil which also indicate health of soil ecosystem [7]. But after pre industrial time soil quality was

degraded day by day due to industrialisation and open cast mining which reduces the soil quality and as a result in agricultural field production decrease.

Soil is the true habitat for microorganisms & it also act as indicator of soil fertility it converts litters into useful nutrients.

Now a day's soil quality is decreasing day by day due to unscientific mining operations which alter physico- chemical characteristics of soil. The most effect tool to restores degraded mining area by ecological restorations and ecosystem restoration process.

Ecological Restorations define as an 'Intentional activity that initiate and accelerate the recovery of an ecosystem with respect to its health, integrity and sustainability. [Society for Ecological Restoration, 2004)

There are two principles of ecological restoration management process are given below:

1) Improve ecosystem structure and functioning.[14]
2) Human System; use natural resources in sustaining manner.[14]

Challenges and opportunities will be change as per degraded levels of specific areas.

Ecological restorations are mainly two types:

A) Natural Restoration.[15]
B) Active Restoration.[15]

Natural Restoration process occurs naturally and time consuming, while Active restoration process occurs by man, fastly working succession process, less time consuming and have high-cost efficiency.[15]

Traditional ecological restoration mainly human centric process as per demand of human we design ecological restoration. Modern Ecological restoration process gives major priories to restore degraded area then human need.[15]

Dhanbad situated in mid of eastern part of the Jharkhand State connecting highways NH-2 and NH-32, and occupied total area; 2074sq.km. Dhanbad District located at23°26'-24°01'North latitude to 86°10'-86°48 East longitude.' It consists of eight blocks namely Baghmara, Baliapur, Dhanbad, Govindpur, Jharia, Nirsa, Topchanchi, and Tundi. [Jharkhand government site]

For this research purpose investigation mainly focuses on agricultural land of Palani Village of Dhanbad District, which comes under Baliapur block free from anthropogenic mining and popularly known for the agricultural practices. On the other hand, compare with the soil quality of mining area, of Dhanbad district is being degraded day to day due to improper and unhygienic practices and not taking care of environmental norms of eco-restoration, causing adverse impact on surrounding local population and severely degrading the quality of air, water, and soil.

This study mainly focuses on how much soil quality degraded mining area is by and its comparison with agricultural soil quality of Palani village block Baliapur block. It includes physical, chemical, macro and micro nutrient analysis. [Jharkhand government site]

The remedial measures suggestion for ecological restoration will be given after the analysis of various parameters. In Dhanbad Jharkhand BCCL was taken pioneer initiative in 2011 to restoration of degrade mine area with help of key tool Ecological restoration their work plan for degraded site plantation of three tier ecological restoration which is given below:

1. Lower grasses: effective for greenery, help for ground water recharging, control soil erosion. [BCCL]

2. Middle tier: shrubs [BCCL]

3. Top level tree. [BCCL]

This three tier plan help to not only for ecological restoration but also help for the food chains, improve climatic condition biodiversity and Socio- economic for livelihood local community. [BCCL Site]

Dhanbad District experiences Sub- tropical climatic condition, hot summer from March to May, monsoon middle June to September and winter from 1st week of November to February end and temperature summer varies from 13.3$^{\circ C}$ to 45.5°C, rainy varies from 15°C to 36°C and winter varies from 8.4°C to 34°C. Texture of soil includes [Jharkhand govt. Site]:

A. Stony and gravels: found near hilly areas

B. Sandy soils: found near River.

C. Loamy soils: near village area.

D. Clayey soil: village.

Alfisol were the dominant soils covering 69.7% and least Inceptisol 7.6%. [Jharkhand government site]

Literature Review

1. The studies carried that mining is dominant source for industrial sectors but due to not proper planning and management for extraction of coal and various mining operations in open cast mining degraded soil quality by compare to parameter pH, Bulk Density, Nitrogen, Phosphorus, Potassium, Electrical Conductivity, Organic Carbon, Moisture Content value low and is not good for agriculture purpose he takes 6 sample at location of Jharia coalfield [1].

2. Studies on infiltration behaviour of water due to soil characteristics in Jharia Township with reference of parameters; bulk density, total porosity, Sand, Organic Matter, Silt, Clay after analysis all values of these parameter fall under category low to medium.[2]

3. Studies to know soil quality near coal mining area by compare paddy field with analysis of parameters such as pH, Electrical Conductivity, Organic Carbon, Organic Matter, Available nitrogen, value low normal which indicate plantations, vegetation and agriculture purpose low.[3]

4. Studies determine origin of trace metal in soil with the help of factors such as; enrichment factor, geo accumulation index and pollution index for evaluating these analysis parameters such as Chromium, Copper, Mercury, Nickel, lead, Zinc mg/kg of soil concentration in agricultural land with the help of method Principal Component Analysis (quantitative analysis) at China.[4]

5. Investigation on soil fertility and stability of overburden dump with help of parameter pH, texture, Moisture, Bulk density, Porosity, Permeability, Organic Carbon, Total Nitrogen, Total Phosphorus, and native grass species respectively by analysis data compare between forest, mine Spoil, and Re-vegetation mine spoils found that re vegetation mine spoil area organic and inorganic nutrient helps to restore vegetation and grass increase stability of overburden dump. [5]

6. Work on assessment of top soil quality in the vicinity of subsided area in Jharia Coalfield total number of sample 10 analyses with the reference of parameters; pH, Electrical conductivity, Moisture Content, Organic Matter, Available Nitrogen, Available Phosphorus were found that pH slightly low which indicate nutrient not available to plant, EC range low after analysis above parameter they concluded soil quality degrade.[6]

7. Studies on soil quality for agriculture purpose around Barapukuria coal mining area to knowing soil fertility with the reference of 11 parameters; pH, Organic Matter, Potassium, Sulphur, Nitrogen, Phosphorus, Iron, Arsenic, Copper, Nickel, and Total alkalinity compare with IBM SPSS Statics 22 Software found that data higher than standard value and which indicate soil quality degraded.[7]

8. Studies on iron ore mine Nizra Slana, Central Europe impact of soil quality and heavy metal assessment by examine various parameters such pH, C/N , 10 heavy metal; Mercury, Cadmium, Lead, Nickel, Chromium, Zinc, Copper, Iron, Manganese, Magnesium by the help of X- ray fluorescence spectrometry and biological organism measured by Shannon diversity index (H') and check contamination factor final data of above parameter value higher then toxicity limit so it indicate not well for soil ecosystem.[8]

9. Assessed the soil quality near Studies carried out compare of soil sample between nickel post open cast mining to natural forest of Indonesia by analysis chemical properties of soil; pH, Electrical conductivity, Carbon/Nitrogen, Total Nitrogen, Total Carbon, Available Phosphorus, Exchangeable Calcium, Sodium, Magnesium, Potassium, Iron, Nickel and two fast growing native species of tropical forest(*F.molcuccana & A. Saman*) result found that soil quality was degraded.[10]

10. Studies on Magnetite mining area and nearby agriculture land by physicochemical analysis: Nitrogen, Phosphorus, Potassium, pH, Electrical Conductivity, Iron, Zinc, Manganese and Copper using standard process with use of statically analysis correlation for predicting the fertility of sampling the site and divide these

parameters as physical, macronutrient and micronutrient finally analysis concluded that top soil quality loses.[10]

11. Study on species diversity calculation in wasteland of coal mine area of Raniganj counts 57 species of plant belonging to 22 families with help of quadrate of 10m.Sq found that some tolerance species ability ecological succession orderly manner.[11]
12. Studies conducted at Dhanbad District mapping 1:250000 scale on soil quality and [19] soil fertility with reference of parameters such as pH, Electrical Conductivity, Organi Carbon, Available Nitrogen, Available Phosphorus, Available Potassium, As Exchangeable Iron, Zinc and Available Boron by Mridha parikshak Minilab soil kit majority of sample lack of Iron. [12]
13. Studies compare soil of open cast coal mine area to natural agriculture land sample taken at depth of 5ft, 5-10ft,10ft with reference of physicochemical analysis of parameters; pH, Bulk Density, Porosity, Available Nitrogen, Phosphate, Potassium and Organic Carbon among these parameters pH lows which reduce microbial activity with depth, increasing in value of Bulk Density and decrease level of porosity with increase depth, low level of Phosphate and Nitrogen and negligible amount of Potassium.[13]
14. Background of these studies for conserving biodiversity and sustaining livelihood with helps of eco-restoration mainly focuses on their element for management show such as; improve biodiversity, human livelihood, empowered local people and improve productivity with the help of principle practices such as improve ecosystem structure and function and human system use natural resource in sustainable manner.[14]
15. Studies mainly focus on implementation of ecological restoration method in tropical forest restoration by comparison with two methods such as natural restoration and active restoration use method ration [In(x/y)] to quantify a standardizes mean found that effect size between reference and restored system biodiversity and vegetation in both system are lower as compare with reference data.[15]
16. According to studies carried out with mainly focuses on concept and process initial uses for eco-restoration programme for this implementation need such step; introduction ecological problem which restoration, training in step wise process for restoration and problem solve and design to related area. The main goal of studies to established eco-restoration only for human need. [16]

Problem to be investigated

In the proposed study my aim is to analyse the following problem:

- To analysis the soil quality of mining area and comparative study with Agricultural land.
- Study of Physical and Chemical constituents of both soil i.e. mining and Agricultural land.

- Study of macro and micro nutrients of the soil of proposed sites.

- Evaluate the remedial measures to restore the degraded soil quality of mining area and revival of the ecological restoration process.

- Proposal for restoration of socio-economic condition of local inhabitants.

Objective of proposed research work

Assessment of soil quality and present status of agricultural land (Palani Village).

Assessment of soil quality and present status of mining area (Chandmari Colliery; Bera)

Comparatives analysis of soil mining and agricultural land.

Quantitative assessment of physico- chemical parameter of selected sample site.

Socio- economic aspect of proposed work: -

1. The work will focus on remedial measures to restore the degraded soil quality of mining area. Steps to be taken for eco-restoration. Mining activities adopted now a days in open cast mining, which causes severe damage to soil, air and water of the surrounding area. The population near mining area are being adversely affected due to dust, smokes and particulate matter floating in air leading to respiratory problems.
2. The research work will emphasize on how to restore the air, water and soil. What steps should be taken for safe and hygienic mining practices.
3. The greenery lost due to mining activity can be restored by remedial measures and over burden dump should be utilised for the purpose of plantation of wild resistant the plants and other plants which need let's water to grow.
4. The low land of mining area can be utilized for irrigational practices to restore the greenery and other productive uses.

HYPOTHESIS

Soil is a valuable resource and it is also known as true home for microorganisms. It serves the ecosystem for sustainability. It supplies nutrients to flora for productivity due to various anthropogenic activities such as mining; quarrying, industrialisation and human settlement degrade the physical chemical properties of soil as a result of desertification. This study mainly aims to focus on investigation of soil health and to know the status of soil characteristics and properties mining are and its comparison with agriculture land. To

provide suggestions for the ecological restoration remedial measure future benefits for livelihood.

Research tool and methodology

Study area:

Four sampling sites will be taken two from mining areas and two from agricultural land located at Palani Village block Baliapur and Bera (Bastacola) colliery respectively, Dhanbad District.

Agricultural areas:

1) S1: Agriculture land of Palani, block Baliapur.
2) S2: Agriculture land of Palani, block Baliapur.

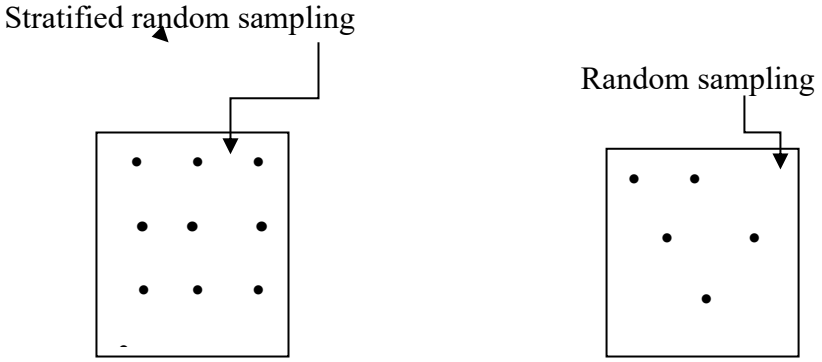
Mining areas:

1) S3: Dhansar Bera Chandmari Colliery (Bera, Bastacola), Bankmore.
2) S4: Dhansar Chandmari Colliery (Bera,Bastacola), Bankmore.

Palani Village located at Baliapur block latitude:23.7218˚N and longitude:86.5163˚E this village free from industries and mining activities. The Palani mainly Village known for agricultural practices.

Chandmari colliery (Bera)located at latitude: 23.7755˚N and longitude: 86.4177˚E, come under BCCl, it is one of the largest mining colliery. The texture of soil degrades day by day due to improper mining activities, causing soil erosion, emission of dust which affects the inhabitants of human population.

Sample collection



Laboratory Method for Physico- Chemical and Qualitative:

1. **Physical**

a) pH: electrode pH meter.

b) EC: Electrode.

c) Moisture content: Gravimetric Method.

d) Organic carbon: Mridha Parikshak [12].

2. Chemical method

a) Macro nutrient:

- Available Nitrogen : Mridha Parikshak.[12]
- Available Phosphorus: Mridha Parikshak.[12]
- Available Potassium: Mridha Parikshak.[12]
- Available Sulphur: Mridha Parikshal. [12]

b) Micro nutrient:

- Available Zinc: Mridha parikshak.[12]
- Available Boron: Mridha parikshak.[12]
- Available Iron: Mridha parikshak.[12]
- Available Copper: Mridha parikshak.[12]
-

Statistical Analysis

1.The Statistical tool SPSS will be used to know how much sample parameter deviates from standard values or done with Microsoft Excel Spread Sheet. [7]

2.Determine the standard error.

Significance:

Improper mining activities such as quarrying, remove coal from the seam, loading of coal and its transportation etc. All these to practices degrade the soil quality due to emission of dust, causes soil erosion, decrease the fertility, loss of biodiversity, disturb the ecological cycle, effect on human health, ultimately fertile land changed into desertification.

The aim of research work to know present status of soil quality of selected sample sites and to make aware local livelihood about the soil quality. It helps people to enhance soil quality by knowing data of different parameters which will test above. In future the mining area can be used for agricultural purpose and will boost the economy of local people, ecological restoration, decreases pollution, help in secondary succession process, restore home for microorganism reduce health risk of local livelihood.

Future Prospect of the Study:

1. This study will give better vision to know present status of soil of agriculture land.
2. This study will give better vision to know present status of soil mining areas.
3. Degradation in soil quality will deteriorate the ecological cycle as result decrease in succession process and indirectly increases pollution level.
4. Research work will focus on remedies of ecological restoration of mining area soil for better living and enhancing the ecological surrounding for faunal growth and development.

Limitations:

The present research has its own limitation which is given below:

(1) During sample collection there may be hindrances and obstacles.

(2) There may be technical lapse during statistical analysis or analysis of parameters.

(3) Error occurs during analysis of samples.

Tentative Chapterization:

Chapter 1: Introduction and literature review.

The section gives an introduction to soil formation and weathering process texture and related.

Chapter 2: Characteristics and Comparisons of soil quality agriculture land to nearby mining area.

The section deal composition of the agricultural soil as compared to mining area soil quality.

Chapter 3: Study areas and sample site.

The sections discuss the study area and sample site topography human population.

Chapter 4: Method and Methodology:

The portion discussion the technical instrument or tool and process used during entire research.

Chapter 5: Result and discussion

In this chapter discuss finding by analysis various parameters.

Chapter 6: Concluding Remarks

The chapter deal with conclusion and remedies on the basics of finding.

Chapter 7: References / Bibliography

This chapter provides the information about references which has used for this research purpose.

Chapter 8: Appendices

This chapter includes tables, maps, images, abbreviation and symbols.

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